

HMM (Hidden Markov Model) -

☀️ What is a Hidden Markov Model (HMM)?

- A **Hidden Markov Model** is a statistical tool used when we can see **results or outcomes**, but not the **actual process** that caused them.
 - It's like trying to guess what's happening **inside a box** by only looking at the signals it sends out.
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🗉 Difference between Markov Model & Hidden Markov Model

- In a **Markov model**, you can **see the state** (like knowing the current weather: sunny, rainy, etc.).
 - In a **Hidden Markov Model**, the **state is hidden**, but you can **see the results** (like hearing thunder or seeing wet streets, but not knowing if it's raining or storming inside the box).
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🔗 Important Terms

- **States:** Hidden things happening (e.g., noun, verb, etc.).
 - **Observations:** What you can see (e.g., words like "Mary", "will", "spot").
 - **Transition Probability:** Chance of moving from one state to another (e.g., noun → verb).
 - **Emission Probability:** Chance of seeing a word given a state (e.g., word "Mary" given it's a noun).
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🧠 How HMM Works in POS Tagging

Let's say we have a sentence:

👉 "Will can spot Mary"

We want to guess the **correct parts of speech** (noun, verb, model verb, etc.) for each word.

🧪 Step-by-step Process

1. List All POS Tags and Words

Example tags: Noun (N), Verb (V), Model verb (M)

Words: Mary, Will, can, spot

2. Collect Probabilities

- **Emission probabilities:** How likely is it that "Mary" is a noun?
Example: $P(\text{Mary} \mid \text{Noun}) = 4/9$

- **Transition probabilities:** How likely is it that a **noun is followed by a verb**?
Example: $P(\text{Verb} \mid \text{Noun}) = 1/4$
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3. Try Tagging a Sentence

Let's tag incorrectly:

👉 "Will (Model), can (Verb), spot (Noun), Mary (Noun)"

When you multiply all emission and transition probabilities for this wrong tagging, the **product = 0**. That means it's **not likely correct**.

4. Try Correct Tags

Correct tag sequence:

👉 "Will (Noun), can (Model), spot (Verb), Mary (Noun)"

Now, multiply the **correct transition and emission probabilities**. You get a **non-zero result**, which means this tagging is more **likely correct**.

How is it used?

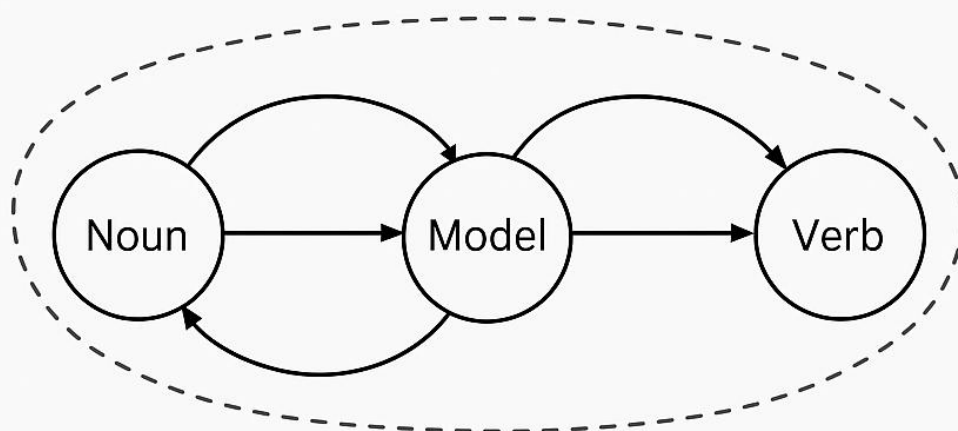
HMMs are used in:

- Speech recognition
 - Text-to-speech
 - Translators
 - Gesture recognition
 - Bioinformatics
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Summary

- Hidden Markov Model helps us **predict hidden things** (like POS tags) using **visible data** (like words).
- It works by using **probabilities** to choose the **most likely** sequence of hidden states (tags).
- In POS tagging, HMM helps assign the correct tag (noun, verb, etc.) to each word in a sentence.

Hidden Markov Model



Emission Probabilities

